

REMARKS

Prior to this Reply, Claims 1, 3, 4, 6-11, 16, 18, 20-27, 29, 33-35 and 38-52 were pending. Through this Reply, Claims 1, 3, 4, 6-11, 16, 18, 22-27, 29, 33-35, 38-40, 42-45, 48 and 51 have been amended, Claims 20, 21, 41, 46, 47, 49, 50 and 52 have been cancelled without prejudice to, or disclaimer of, the subject matter claimed therein, and Claims 53-92 have been added. Accordingly, Claims 1, 3, 4, 6-11, 16, 18, 22-27, 29, 33-35, 38-40, 42-45, 48, 51 and 53-92 are now at issue in the present case.

I. Allowable Subject Matter

Applicant notes, with thanks, the Examiner indication of the allowance of Claim 43.

The Examiner objected to Claims 21-24, 47 and 50 as being dependent upon a rejected base claim. However, the Examiner indicated that such claims would be allowable if rewritten in independent form to include all of the limitations of their respective base claims and any intervening claims.

Applicant has amended Claim 16 to include the limitations of objected-to Claim 21. Accordingly, Claims 20 and 21 have been cancelled.

Applicant has also amended Claim 44 to include the limitations of objected-to Claim 47. Accordingly, Claims 46 and 47 have been cancelled.

Applicant has also amended Claim 48 to include the limitations of objected-to Claim 50. Accordingly, Claims 49 and 50 have been cancelled.

II. Rejection of Claims 33-35 and 38 Under 35 U.S.C. § 102(b)

The Examiner rejected Claims 33-35 and 38 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,963,393 to Rowan et al. (hereinafter "Rowan").

Rowan discloses disk drive 100 that includes voice coil 110, VCM driver 115, voltage supply 200, sense resistor 204, sense amplifier 206, coil sensor 208, summer 210, sample-hold unit 212, multiplier 214 and switches 216 and 218.

VCM driver 115 provides voltage supply 200 that generates current through the series connection of voice coil 110 and sense resistor 204. Sense amplifier 206 measures the voltage across sense resistor 204, and coil sensor 208 measures the voltage across voice coil 110. Switch 216 multiplexes sample-hold-unit 212 and multiplier 214 to summer 210. Switch 218 connects and disconnects coil sensor 208 and sample-hold unit 212. Summer 210 generates the back EMF voltage of voice coil 110.

Rowan calculates the back EMF voltage using sample-hold-unit 212 without sense resistor 204, sense amplifier 206 or multiplier 214. In this approach, switch 216 connects sample-hold unit 212 to summer 210 and disconnects multiplier 214 from summer 210. Switch 218 connects sample-hold unit 212 to coil sensor 208 to sample the voltage across voice coil 110 while voice coil 110 is stationary, and switch 218 disconnects sample-hold unit 212 from the voice coil 110 voltage while voice coil 110 is moving. Summer 210 generates the back EMF voltage as the difference between the voice coil voltage and the sample-hold voltage.

Rowan also calculates the back EMF voltage using sense resistor 204, sense amplifier 206 and multiplier 214 without sample-hold-unit 212. In this approach, switch 216 connects multiplier 214 to summer 210 and disconnects sample-hold unit 212 from summer 210. Multiplier 214 multiplies the sense resistor voltage (V_s) by the nominal resistance of voice coil

110 divided by the resistance of sense resistor 204 (R_{cn}/R_s) to provide an estimated coil resistance voltage. Summer 210 generates the back EMF voltage as the difference between the voice coil voltage and the estimated coil resistance voltage.

Applicant has amended Claim 33 to recite “a first operational amplifier for amplifying a voltage across the VCM; a second operational amplifier for amplifying a voltage across the sense resistor; a multiplexer for multiplexing the amplified voltages; and a microprocessor for calculating a back EMF voltage based on the multiplexed voltages.”

Rowan fails to teach or suggest calculating the back EMF voltage based on multiplexed voltages. Instead, summer 210 calculates the back EMF voltage using coil sensor 208 and sample-hold-unit 212 with switch 216 in position B, or summer 210 calculates the back EMF voltage using coil sensor 208 and multiplier 214 with switch 216 in position A. In no instance does summer 210 calculate a back EMF voltage using multiplexed voltages from sample-hold unit 212 and multiplier 214 as switch 216 toggles between positions A and B.

In view of the above, Applicant submits that Claim 33, and the claims that depend therefrom, are patentably distinguishable from Rowan.

III. Rejection of Claims 1, 27 and 29 Under 35 U.S.C. § 102(e)

The Examiner rejected Claims 1, 27 and 29 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication No. 2002/0196577 to Harmer (hereinafter “Harmer”).

Harmer discloses disk drive 20 that includes actuator arm 32, voice coil element 43 and back EMF sensing circuit 520 that includes operational amplifiers OA_1 and OA_2 , L compensation portion 600, higher order compensation portion 610, gain adjust 620 and integrator feedback 630.

Operational amplifier OA₁ amplifies a voltage across voice coil element 43, operational amplifier OA₂ amplifies a voltage across a series sense resistor, and gain adjust 620 subtracts the scaled sense resistor voltage from the voice coil element voltage to provide a back EMF voltage that indicates a rotational velocity of actuator arm 32. The actuator control system is calibrated at power up.

Applicant has amended Claims 1 and 27 to recite “providing multiplexed voltages using the VCM and sense resistor voltages; calculating a back EMF voltage using the multiplexed voltages.”

Harmer fails to teach or suggest calculating the back EMF voltage using multiplexed voltages. Instead, operational amplifier OA₁ sends the amplified voltage of voice coil element 43 through L compensation portion 600 to operational amplifier OA₃, and operational amplifier OA₂ sends the amplified voltage of the sense resistor through higher order compensation portion 610 and gain adjust 620 to operational amplifier OA₃. No voltage multiplexing occurs.

In view of the above, Applicant submits that Claims 1 and 27, and the claims that depend therefrom, are patentably distinguishable from Harmer.

IV. Rejection of Claims 16, 20, 25, 26, 44-46, 48, 49 and 51 Under 35 U.S.C. § 102(b)

The Examiner rejected Claims 16, 20, 25, 26, 44-46, 48, 49 and 51 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,081,112 to Carobolante et al. (hereinafter “Carobolante”).

Carobolante discloses a mass storage device that includes coil 11, sense resistor 14, first amplifier 22, summer circuit 24 and second amplifier 26.

A current is applied to the series connection of coil 11 and sense resistor 14, first amplifier 22 amplifies the voltage across coil 11, second amplifier 26 amplifies the voltage across sense resistor 14, and summer circuit 24 generates the back EMF voltage based on the amplified voltages to reduce velocity error.

Applicant has amended Claims 16, 44 and 48 to include the limitations of objected-to Claims 21, 47 and 50, respectively.

In view of the above, Applicant submits that Claims 16, 44 and 48, and the claims that depend therefrom, are patentably distinguishable from Carobolante.

V. Rejection of Claims 39-41 Under 35 U.S.C. § 103(a)

The Examiner rejected Claims 39-41 under 35 U.S.C. § 103(a) as being unpatentable over Rowan. Claims 39 and 40 depend (indirectly) from Claim 33, and Claim 41 has been cancelled. Accordingly, Claims 39 and 40 are patentably distinguishable from Rowan, at least, because such claims depend from Claim 33.

VI. Rejection of Claim 42 Under 35 U.S.C. § 103(a)

The Examiner rejected Claim 42 under 35 U.S.C. § 103(a) as being unpatentable over Rowan in view of Applicant's admitted prior art as discussed in the background of the invention (hereinafter "AAPA"). Claim 42 depends from Claim 33. Accordingly, Claim 42 is patentably distinguishable from Rowan and AAPA, at least, because such claim depends from Claim 33.

VII. Rejection of Claims 3 and 4 Under 35 U.S.C. § 103(a)

The Examiner rejected Claims 3 and 4 under 35 U.S.C. § 103(a) as being unpatentable over Harmer in view of AAPA. Claims 3 and 4 depend from Claim 1. Accordingly, Claims 3 and 4 are patentably distinguishable from Harmer and AAPA, at least, because such claims depend from Claim 1.

VIII. Rejection of Claims 6, 10, 11 and 52 Under 35 U.S.C. § 103(a)

The Examiner rejected Claims 6, 10, 11 and 52 under 35 U.S.C. § 103(a) as being unpatentable over Harmer in view of U.S. Patent No. 6,643,088 to Kawachi (hereinafter “Kawachi”). Claims 6, 10 and 11 depend (directly or indirectly) from Claim 1, and Claim 52 has been cancelled. Accordingly, Claims 6, 10 and 11 are patentably distinguishable from Harmer and Kawachi, at least, because such claims depend from Claim 1.

IX. Rejection of Claims 7-9 Under 35 U.S.C. § 103(a)

The Examiner rejected Claims 7-9 under 35 U.S.C. § 103(a) as being unpatentable over Harmer and Kawachi in view of AAPA. Claims 7-9 depend (indirectly) from Claim 1. Accordingly, Claims 7-9 are patentably distinguishable from Harmer, Kawachi and AAPA, at least, because such claims depend from Claim 1.

X. Rejection of Claim 18 Under 35 U.S.C. § 103(a)

The Examiner rejected Claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Carobolante in view of Kawachi. Claim 18 depends from Claim 16. Accordingly, Claim 18 is

patentably distinguishable from Carobolante and Kawachi, at least, because such claim depends from Claim 16.

XI. Rejection of Claim 18 Under 35 U.S.C. § 112

The Examiner rejected Claim 18 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner noted that “the Proportional-Integral control technique” lacks positive antecedent basis.

In response, Applicant has amended Claim 18 to recite “a proportional-integral control technique.” Accordingly, Applicant believes that the rejection of Claim 18 has been overcome.

XII. New Claims

Claims 53-92 have been added. No new matter has been added.

Claim 53 recites “calculating a back EMF voltage of the VCM based on the multiplexed voltages.” Therefore, Claim 53 is believed to be allowable for at least the same reasons as Claims 1, 27 and 33.

Claims 54-72 depend from Claim 53 and are believed to be allowable for at least the same reasons as Claim 53.

Claim 73 is believed to be allowable for at least the same reasons as Claim 53. Claims 74-82 depend from Claim 73 and are believed to be allowable for at least the same reasons as Claim 73.

Claim 83 is believed to be allowable for at least the same reasons as Claim 53. Claims 84-92 depend from Claim 83 and are believed to be allowable for at least the same reasons as Claim 83.

XIII. Amendments to Claims

The claims have been amended to improve clarity. No new matter has been added.

XIV. Amendments to Specification

A substitute specification without claims (and a marked-up version thereof) is provided herein under 37 C.F.R. 1.125 to improve clarity of the specification. No new matter has been added.

Applicant respectfully requests that the substitute specification be entered.

XV. Amendments to Drawings

Applicant is submitting replacement Figures 1-6 (contained on Replacement Sheets 1-4) to improve the quality of the drawings.

Figure 1 has been modified to clarify voice coil motor 105, disk 110, cover 115, actuator arm 120, spindle 125, DC power input 130, head 135, base casting 140, I/O connector 145, printed circuit board 150, frame/bracket 155, connector 160, printed circuit cable 165 and shock mount 170 and to delete the text.

Figure 2 has been modified to clarify disk drive 100, voice coil motor 105, disk 110, actuator arm 120, head 135, ramp 175, lift tab 180, read/write position 185 and park position 190 and to delete the text.

Figure 3 has been modified to clarify VCM internal resistance 105A, VCM back EMF voltage 105B, sense resistor 195, driver 305, first operational amplifier 310, second operational amplifier 315, multiplexer 320, analog-to-digital converter 325 and microprocessor 330 and to delete “driver circuit and output stage” and reference numerals 353, 356 and 357 and “input” and “out1” and “out2” and “1” and “2” and “P1” (three instances) and “P2” (two instances) and “P3.”

Figure 4 has been modified to renumber steps 410, 420, 425, 430, 440, 450, 460 and 470 as steps 405, 410, 415, 420, 425, 430, 435 and 440, respectively, and to revise steps 410, 415, 420, 425, 430 and 435.

Figure 5 has been modified to label flow chart 500 and steps 505, 510, 515, 520, 525, 530, 535, 540, 545, 550, 555, 560, 565, 570, 575, 580, 585, 590 and 595, and to revise steps 515, 520, 525, 530, 535, 540, 545, 550, 555, 560, 565, 570, 575, 580 and 585.

Figure 6 has been modified to renumber steps 610, 620, 630, 640, 650, 655 and 660 as steps 605, 610, 615, 620, 625, 630 and 635, respectively, and to revise steps 610, 615, 620 and 625.

No new matter has been added. Figures 1-6 constitute all of the drawings of the application.

XVI. Additional Claim Fees

In determining whether additional claim fees are due, reference is made to the Fee Calculation Table (below).

Fee Calculation Table

| | Claims Remaining After Amendment | | Highest Number Previously Paid For | Present Extra | Rate | Additional Fee |
|---------------------------------|-------------------------------------|-------|---------------------------------------|------------------|-----------|----------------|
| Total (37 CFR 1.16(c)) | 70 | Minus | 42 | = 28 | x \$50 = | \$1400.00 |
| Independent (37 CFR 1.16(b)) | 10 | Minus | 7 | = 3 | x \$200 = | \$600.00 |

As set forth in the Fee Calculation Table (above), Applicant previously paid claim fees for forty-two (42) total claims and for seven (7) independent claims. Therefore, Applicant hereby authorizes the Commissioner to charge the credit card identified on the enclosed Form PTO-2038 in the amount of \$2000.00 for the presentation of twenty-eight (28) total claims over forty-two (42) and three (3) independent claims over seven (7). Although Applicant believes that no other fees are due, the Commissioner is hereby authorized to charge Deposit Account No. 50-2198 for any fee deficiencies associated with filing this paper.

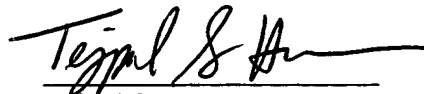
XVII. Conclusion

It is believed the above comments establish patentability. Applicant does not necessarily accede to the assertions and statements in the Office Action, whether or not expressly addressed.

Applicant believes that the application appears to be in form for allowance. Accordingly, reconsideration and allowance thereof is respectfully requested.

The Examiner is invited to contact the undersigned at the below-listed telephone number regarding any matters relating to the present application.

Respectfully submitted,



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